



## SEQUENCE LISTING

<110> Toni, Kutchan  
Anthony, Fist  
David, Atkins  
Meinhart, Zenk

<120> CODEINONE REDUCTASE FROM ALKALOID POPPY

<130> J&J-1825

<140> 09/937665  
<141> 2001-09-26

<150> PCT/AU00/00249  
<151> 2000-03-24

<150> AU PP 9463  
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<170> PatentIn version 3.1

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21

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Val Leu His Gln Ile Ala Val Ala Arg Gly Lys  
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Lys Gln Gly Tyr Arg His Phe Asp Thr Ala Ala Ala Tyr Gly Ser Glu  
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Gln Ala Leu Gly Glu Ala Leu Lys Glu Ala Ile Glu Leu Gly Leu Val  
20 25 30

Thr Arg Glu Glu Leu Phe Val Thr Ser Lys Leu Trp Val Thr Glu Asn  
35 40 45

His Pro His Leu Val Ile Pro Ala Leu Gln Lys Ser Leu Lys Thr Leu  
50 55 60

Gln Leu Asp Tyr Leu Asp Leu Tyr Ile His Trp Pro Leu Ser Ser  
65 70 75 80

Gln Pro Gly Lys Phe Ser Phe Pro Ile Asp Val Ala Asp Leu Leu Pro  
85 90 95

Phe Asp Val Lys Gly Val Trp Glu Ser Met Glu Glu Ser Leu Lys Leu  
100 105 110

Gly Leu Thr Lys Ala Ile Gly Val Ser Asn Phe Ser Val Lys Lys Leu  
115 120 125

Glu Asn Leu Leu Ser Val Ala Thr Val Leu Pro Ala Val Asn Gln Val  
130 135 140

Glu Met Asn Leu Ala Trp Gln Gln Lys Lys Leu Arg Glu Phe Cys Asn  
145 150 155 160

Ala Asn Gly Ile Val Leu Thr Ala Phe Ser Pro Leu Arg Lys Gly Ala  
165 170 175

Ser Arg Gly Pro Asn Glu Val Met Glu Asn Asp Met Leu Lys Glu Ile  
180 185 190

Ala Asp Ala His Gly Lys Ser Val Ala Gln Ile Ser Leu Arg Trp Leu  
195 200 205

Tyr Glu Gln Gly Val Thr Phe Val Pro Lys Ser Tyr Asp Lys Glu Arg  
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Met Asn Gln Asn Leu Cys  
225 230

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1 5 10 15

Thr Ala Leu Gly Glu Ala Leu Lys Glu Ala Arg Asp Leu Gly Leu Val  
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Thr Arg Glu Glu Leu Phe Val Thr Ser Lys Leu Trp Val Thr Glu Asn  
35 40 45

His Pro His Leu Val Ile Pro Ala Leu Arg Lys Ser Leu Glu Thr Leu  
50 55 60

Gln Leu Glu Tyr Leu Asp Leu Tyr Leu Ile His Trp Pro Leu Ser Ser  
65 70 75 80

Gln Pro Gly Lys Phe Ser Phe Pro Ile Gln Val Glu Asp Leu Leu Pro  
85 90 95

Phe Asp Val Lys Gly Val Trp Glu Ser Met Glu Glu Cys Leu Lys Leu  
100 105 110

Gly Leu Thr Lys Ala Ile Gly Val Ser Asn Phe Ser Val Lys Lys Leu  
115 120 125

Gln Asn Leu Leu Ser Val Ala Thr Ile Arg Pro Ala Val Asn Gln Val

130

135

140

Glu Met Asn Leu Ala Trp Gln Gln Lys Lys Leu Arg Glu Phe Cys Thr  
145 150 155 160

Ala Asn Gly Ile Val Leu Thr Ala Phe Ser Pro Leu Arg Lys Gly Ala  
165 170 175

Ser Arg Gly Pro Asn Glu Val Met Glu Asn Asp Met Leu Lys Gly Ile  
180 185 190

Ala Glu Ala His Gly Lys Ser Ile Ala Gln Val Ser Leu Arg Trp Leu  
195 200 205

Tyr Glu Gln Gly Val Thr Phe Val Ala Lys Ser Tyr Asp Lys Glu Arg  
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Met Asn Gln Asn Leu Gln  
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20 25 30

Ser Arg Gln Asp Leu Phe Val Thr Ser Lys Leu Trp Val Thr Glu Asn  
35 40 45

His Pro His Leu Val Leu Pro Ala Leu Arg Lys Ser Leu Lys Thr Leu  
50 55 60

Gln Leu Glu Tyr Leu Asp Leu Tyr Leu Ile His Trp Pro Leu Ser Ser  
65 70 75 80

Gln Pro Gly Lys Phe Ser Phe Pro Ile Glu Val Glu Asp Leu Leu Pro  
85 90 95

Phe Asp Val Lys Gly Val Trp Glu Ser Met Glu Glu Cys Gln Lys Leu  
100 105 110

Gly Leu Thr Lys Ala Ile Gly Val Ser Asn Phe Ser Val Lys Lys Leu  
115 120 125

Gln Asn Leu Leu Ser Val Ala Thr Ile Arg Pro Val Val Asp Gln Val  
130 135 140

Glu Met Asn Leu Ala Trp Gln Gln Lys Lys Leu Arg Glu Phe Cys Lys  
145 150 155 160

Glu Asn Gly Ile Ile Val Thr Ala Phe Ser Pro Leu Arg Lys Gly Ala  
165 170 175

Ser Arg Gly Pro Asn Glu Val Met Glu Asn Asp Val Leu Lys Glu Ile  
180 185 190

Ala Glu Ala His Gly Lys Ser Ile Ala Gln Val Ser Leu Arg Trp Leu  
195 200 205

Tyr Glu Gln Gly Val Thr Phe Val Pro Lys Ser Tyr Asp Lys Glu Arg  
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Met Asn Gln Asn Leu His  
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<210> 19  
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Val Val Asn Gln Val Glu Met Ser Pro Thr Leu Val Leu His Gln Ile

20

25

30

Ala Val Ala Arg Gly Lys Val Asn Glu Ile Pro Lys  
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1 5 10 15

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Ala Cys Thr Cys Thr Cys Ala Gly Thr Thr Cys Cys Gly Gly Cys Ala  
35 40 45

Thr Thr Cys Gly Gly Ala Thr Gly Cys Cys Thr Gly Cys Thr Thr Thr  
50 55 60

Ala Gly Gly Thr Ala Thr Gly Gly Ala Ala Cys Ala Gly Cys Thr  
65 70 75 80

Gly Ala Ala Ala Cys Ala Ala Thr Gly Gly Thr Ala Ala Ala Gly  
85 90 95

Gly Ala Ala Cys Ala Gly Ala Ala Gly Ala Gly Ala Gly Ala Ala  
100 105 110

Ala Thr Thr Gly Gly Cys Gly Thr Thr Thr Thr Gly Ala Ala Ala  
115 120 125

Gly Cys Gly Ala Thr Ala Gly Ala Gly Gly Thr Cys Gly Gly Thr Thr  
130 135 140

Ala Cys Ala Gly Ala Cys Ala Cys Thr Thr Cys Gly Ala Thr Ala Cys  
145 150 155 160

Ala Gly Cys Thr Gly Cys Thr Gly Cys Ala Thr Ala Cys Cys Ala Ala  
165 170 175

Ala Cys Thr Gly Ala Ala Gly Ala Gly Thr Gly Thr Cys Thr Thr Gly  
180 185 190

Gly Thr Gly Ala Ala Gly Cys Thr Ala Thr Ala Gly Cys Thr Gly Ala  
195 200 205

Ala Gly Cys Ala Cys Thr Thr Cys Ala Ala Cys Thr Thr Gly Gly Thr  
210 215 220

Cys Thr Ala Ala Thr Ala Ala Ala Ala Thr Cys Thr Cys Gly Ala Gly  
225 230 235 240

Ala Thr Gly Ala Ala Cys Thr Cys Thr Cys Ala Thr Cys Ala Cys  
245 250 255

Thr Thr Cys Cys Ala Ala Gly Cys Thr Cys Thr Gly Gly Thr Gly Cys  
260 265 270

Gly Cys Thr Gly Ala Thr Gly Cys Thr Cys Ala Cys Gly Cys Thr Gly  
275 280 285

Ala Thr Cys Thr Thr Gly Thr Cys Cys Thr Cys Cys Cys Thr Gly Cys  
290 295 300

Thr Cys Thr Thr Cys Ala Gly Ala Ala Thr Thr Cys Thr Cys Thr Gly  
305 310 315 320

Ala Gly Gly Ala Ala Thr Cys Thr Thr Ala Ala Ala Thr Thr Gly Gly  
325 330 335

Ala Cys Thr Ala Thr Cys Thr Thr Gly Ala Thr Cys Thr Ala Thr Ala  
340 345 350

Thr Thr Thr Gly Ala Thr Ala Cys Ala Cys Cys Ala Thr Cys Cys Gly  
355 360 365

Gly Thr Ala Ala Gly Cys Thr Thr Gly Ala Ala Gly Cys Cys Ala Gly  
370 375 380

Gly Gly Ala Ala Gly Thr Thr Gly Thr Thr Ala Ala Cys Gly Ala  
385 390 395 400

Ala Ala Thr Ala Cys Cys Ala Ala Ala Gly Gly Ala Thr Cys Ala Thr  
405 410 415

Ala Thr Cys Cys Thr Thr Cys Cys Ala Ala Thr Gly Gly Ala Cys Thr  
420 425 430

Ala Cys Ala Ala Ala Thr Cys Thr Gly Thr Ala Thr Gly Gly Gly Cys  
435 440 445

Ala Gly Cys Cys Ala Thr Gly Gly Ala Ala Gly Ala Gly Thr Gly Thr  
450 455 460

Cys Ala Gly Ala Cys Cys Cys Thr Thr Gly Gly Cys Thr Thr Cys Ala  
465 470 475 480

Cys Thr Ala Gly Gly Cys Ala Ala Thr Cys Gly Gly Gly Thr  
485 490 495

Cys Thr Gly Thr Ala Ala Thr Thr Cys Thr Cys Ala Thr Gly Cys  
500 505 510

Ala Ala Ala Ala Gly Gly Cys Thr Thr Cys Ala Ala Gly Ala Gly Thr  
515 520 525

Thr Gly Ala Thr Gly Gly Ala Ala Ala Cys Ala Gly Cys Cys Ala Ala  
530 535 540 545

Cys Ala Gly Cys Cys Cys Thr Cys Cys Ala Gly Thr Thr Gly Thr Gly  
550 555 560

Ala Ala Thr Cys Ala Ala Gly Thr Gly Ala Gly Ala Thr Gly Ala  
565 570 575

Gly Cys Cys Cys Gly Ala Cys Thr Thr Ala Cys Ala Thr Cys Ala

580

585

590

Ala Ala Ala Ala Ala Ala Thr Cys Thr Gly Ala Gly Gly Ala Ala  
595 600 605

Thr Ala Thr Thr Gly Cys Ala Ala Gly Gly Cys Cys Ala Ala Thr Ala  
610 615 620

Ala Thr Ala Thr Cys Ala Thr Gly Ala Thr Cys Ala Cys Cys Gly Cys  
625 630 635 640

Ala Cys Ala Cys Thr Cys Ala Gly Thr Thr Thr Gly Gly Gly Ala  
645 650 655

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675 680 685

Thr Ala Thr Gly Cys Ala Thr Thr Cys Thr Ala Ala Gly Gly Thr Gly  
690 695 700

Cys Thr Thr Cys Ala Cys Cys Ala Gly Ala Thr Thr Gly Cys Thr Gly  
705 710 715 720

Thr Gly Gly Cys Cys Ala Gly Ala Gly Ala Ala Ala Ala Thr Cys  
725 730 735

Thr Gly Thr Thr Gly Cys Cys Ala Gly Gly Thr Thr Ala Gly Thr  
740 745 750

Ala Thr Gly Ala Gly Ala Thr Gly Gly Thr Thr Thr Ala Cys Cys  
755 760 765

Ala Gly Cys Ala Ala Gly Gly Cys Gly Cys Gly Ala Gly Thr Cys Thr  
770 775 780

Thr Gly Thr Gly Gly Thr Gly Ala Ala Ala Ala Gly Thr Thr Thr Cys  
785 790 795 800

Ala Ala Thr Gly Ala Ala Gly Cys Gly Ala Gly Gly Ala Thr Gly Ala  
805 810 815

Ala Gly Gly Ala Ala Ala Cys Cys Thr Thr Ala Ala Gly Ala Thr  
820 825 830

Ala Thr Thr Thr Gly Ala Thr Thr Gly Gly Ala Ala Cys Thr Ala  
835 840 845

Ala Cys Gly Gly Cys Ala Gly Ala Ala Gly Ala Cys Ala Thr Gly Gly  
850 855 860

Ala Ala Ala Ala Gly Ala Thr Cys Ala Gly Thr Gly Ala Gly Ala Thr  
865 870 875 880

Thr Cys Cys Ala Cys Ala Ala Thr Cys Thr Ala Gly Ala Ala Cys Ala  
885 890 895

Ala Gly Cys Thr Cys Thr Gly Cys Thr Gly Cys Thr Thr Cys Thr  
900 905 910

Thr Gly Thr Thr Ala Thr Cys Ala Cys Cys Gly Ala Cys Thr Gly Gly  
915 920 925

Ala Cys Cys Thr Thr Cys Ala Ala Ala Ala Cys Thr Gly Ala Ala  
930 935 940

Gly Ala Ala Gly Ala Gly Thr Thr Cys Thr Gly Gly Ala Thr Gly  
945 950 955 960

Ala Gly Ala Ala Gly Gly Ala Thr Thr Gly Ala Ala Ala Cys Ala Thr  
965 970 975

Cys Ala Ala Thr Thr Ala Thr Ala Gly Ala Thr Gly Gly Thr Ala Ala  
980 985 990

Gly Thr Gly Ala Gly Gly Ala Cys Thr Gly Thr Cys Ala Ala Ala Ala  
995 1000 1005

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Cys Cys Cys Thr Cys Cys Gly Thr Thr Thr Thr Gly  
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aatgcatacg aggtcggtt cagacacttc gatacagctg ctgcataccca aagtgaagag      180
tgtcttggtg aagctatacg tgaagcactt caacttggtt taataaaaatc tcgagatgaa      240
ctcttcatca cttccaagct ctggtgcgct gatgctcacg ctgatcttgc cttccctgct      300
cttcagaatt ctctgaggaa tctcaaattt gagtacccgg atcttatattt gatacaccat      360
ccggtaagct tgaagccagg gaagcttggtt aacgaaatac caaaggatca tattcttcca      420
atggactaca aatctgtatg ggcagccatg gaagagtgtc agacccttgg cttcactagg      480
gcaatcggtg ttagtaattt ctcatgcaaa aagcttcaag agttgatggc aacagccaag      540
atccctccag ttgtgaatca agtggagatg agcccgactt tacatcaaaa aaatctgagg      600
gaatattgca aggccaataa tatcatgatc actgcacact cggtttggg agccataggt      660
gctccatggg gcagcaacgc agttatggat tctaagggtgc ttcaccagat tgctgtggca      720
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gtggtgaaaaa gtttcaatga agcgaggatg aaggaaaacc ttaagatatt tgattcgaa      840
ctaacggcag aagatatgga aaagatcagt gagattccgc aatctagaac aagctctgct      900
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gattga                                              966

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aaagcgatag aggtcggtta cagacacttc gatacagctg ctgcataccca aagtgaagag	180
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atccctccag ttgtgaatca agtggagatg agcccgactt tacatcaaaa aaatctgagg	600
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agagggaaat ctgttgcggc ggttagtatg agatgggtt accagcaagg cgcgagtcta	780
gtggtaaaaa gtttcaatga agggaggatg aaggaaaacc ttaagatatt tgattggaa	840
ctaacggcag agaatatgga aaagatcagt gagattccgc aatctagaac aagctctgct	900
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aaagcgatag aggtcggtta cagacacttc gatacagctg ctgcataccca aagtgaagag	180
tgtcttggtg aagctatagc tgaagcactt caacttggtt taataaaatc tcgagatgaa	240

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ccggtaagct	tgaagccagg	gaaatttgtt	aacgaaatac	caaaggatca	tattttcca	420
atggactaca	aatctgtatg	ggcagccatg	gaagagtgtc	agacccttgg	cttcactagg	480
gcaatcggtg	ttagtaattt	ctcatgcaaa	aagcttcaag	agttgatggc	agcagccaag	540
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gaatattgca	aggccaataa	tatcatgatc	actgcacact	cggttttggg	agccataggt	660
gctccatggg	gcagcaatgc	agttatggat	tctaaggtgc	ttcaccagat	tgctgtggca	720
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gtggtgaaaa	gtttcaatga	aggaggatg	aaggaaaacc	ttaagatatt	tgattggaa	840
ctaacggcag	aagatatgga	aaagatcagt	gagattccgc	aatctagaac	aagctctgct	900
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gattga						966

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caaggccaaat	aatatcatga	tcactgcaca	ctcggttttg	ggagccatag	gtgctccatg	120
ggcagcaat	gcagttatgg	attctaaggt	gttt			154

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 <223> partial sequence codeinone reductase isoform

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ggaaagcttg ttaacgaaat accaaaggat catattttc caatggacta caaatctgta 180  
tggcagcca tgaaagagtg tcagaccctt ggcttcacta gggcaatcggttgtcagtaat 240  
ttctcatgca aaaagcttca agagttgatg gcaacagcca agatccctcc a 291